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PENETRATING WOUNDS OF THE EYE, COMPLICATED BY THE PRESENCE OF A FOREIGN BODY IN THE EYEBALL.

BY

A. MAITLAND RAMSAY, M.D.,

Fellow of Faculty of Physicians and Surgeons, Glasgow; Ophthalmic Surgeon, Glasgow Royal Infirmary; Professor of Ophthalmology, St. Mungo's College, Glasgow; and Lecturer on Eye Diseases, Queen Margaret College, University of Glasgow.

PENETRATING wounds of the eye are at all times serious, and the prognosis becomes very much more grave when such injuries are complicated by the presence of a foreign body in the interior of the eyeball. In every large industrial centre such accidents are of daily occurrence, and few cases give the practitioner greater cause for concern, inasmuch as no matter how trivial an eye injury may seem, there is always the risk of disastrous after-results. The fate of the damaged eye depends indeed, in most instances, on the treatment first adopted, and at all times one's sense of responsibility is intensified by the knowledge that a wound of one eye may be followed by sympathetic inflammation of its fellow, and that this may be so severe as to cause complete loss of vision. The seven cases which follow have been recorded and arranged so as to present a clinical picture of the results, immediate and remote, that may follow penetrating wounds of the eye complicated by the presence of a foreign body in the eyeball.

1. W. T., aged 26, an ironturner by occupation, was sent to consult me in March, 1900, by Dr. Brown of Pollokshields. On the 2nd of October, 1899, he was struck on the left eye by a chip of steel, which perforated the cornea and embedded itself in the lens. The accident had apparently been followed by very little inflammatory reaction, and, when I first saw the patient, the eye presented a perfectly natural appearance, and

the visual acuity was quite up to the normal standard. When the pupil was dilated by atropine, and the eye examined by the ophthalmoscope, a minute black glistening particle was seen lying in the lens, which, however, with the exception of the area immediately enveloping the foreign body, had lost none of its transparency. Since a small foreign body situated in the lens does not usually cause inflammation of the eye, and as any attempt to extract this tiny fragment of metal would certainly have been followed by traumatic cataract, the patient was advised to let well alone, but to report himself regularly so that the eye might be kept under observation. For eleven months his progress was all that could be desired, but on the evening of the 26th January, 1901, the eye, without any warning, and for no reason known to the patient, became excessively painful, and sight disappeared completely a few hours afterwards. On the following morning the eye had lost perception of light, and was red, painful, and tender to touch, but of normal tension, the iris was discoloured, the pupil was contracted and did not dilate after the instillation of atropine, and the fundus oculi could not be illuminated. The patient was sent to bed and after treatment by atropine, opiates, leeches, and fomentations, the cyclitis subsided and light perception returned; but the media were so muddy that the interior of the eyeball could not be examined, and the iris, which was formerly of a light blue colour, had become a deep reddish brown. An X-ray photograph was taken, and demonstrated the presence of the foreign body (Plate 1, fig. 1) in the lens, exactly as it was before the occurrence of the inflammatory attack. As a result of the cyclitis the lens had become much more cataractous, and in consequence, on the 13th of March, it was extracted by a superior linear section. This led to great improvement of vision, and a skiagram taken ten days after the operation showed that the foreign body was gone. This case is still under treatment, and although the patient is now able to distinguish large objects there is great risk that the cyclitis may return and that the eye may ultimately require to be enucleated.

2. It is only very occasionally, however, that a foreign body is thus visible; in most instances it rapidly becomes concealed

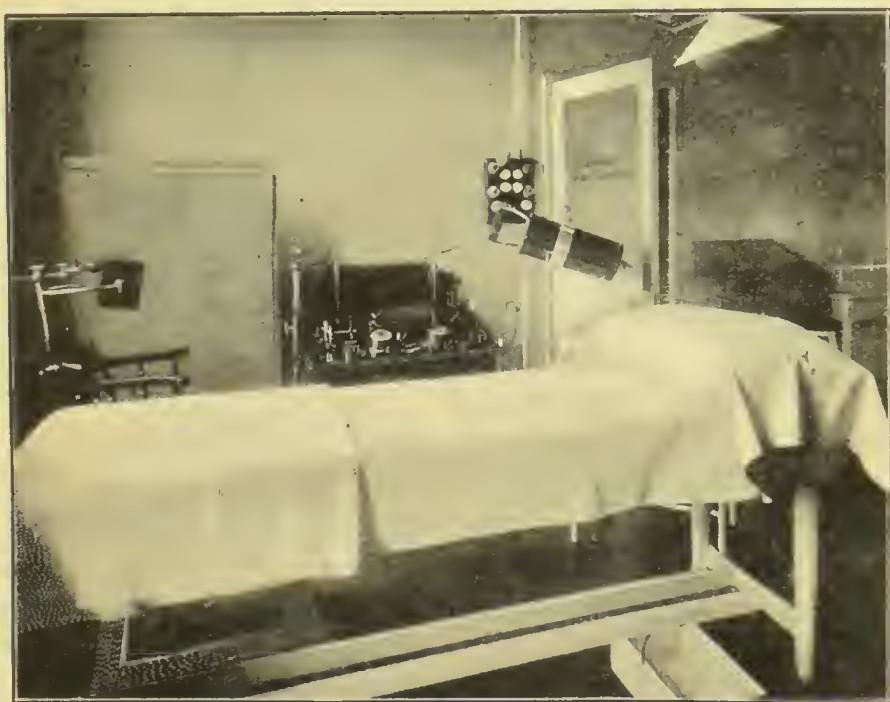
by haemorrhage, or hidden by increasing opacity of the lens. It is therefore of the first importance that the eye be thoroughly examined at the earliest possible moment after the accident; and the nature of the latter, along with its attendant circumstances, ought always to be carefully and fully elicited. Obviously an eye which has been penetrated by the prong of a fork, or cut by a knife, is not at all likely to contain a foreign body; but, on the other hand, when the accident has been due to a blow from a chip of steel, of glass, or of stone, or where it has been the result of an exploding cartridge, or of a shot pellet, then the risk that the missile has become lodged in the globe is exceedingly great. The illustration (Plate 2, fig. 1) is from the eye of a girl, K. S., 17 years of age, who was sent to me by Dr. Newman, with the history that while she was working at a pithead on the 16th of February last she accidentally struck a dynamite cartridge, which exploded, blew off a part of her left hand, and seriously injured the eye on the same side. There was a small penetrating wound at the upper and outer aspect of the cornea, the iris was torn, the aqueous was stained by blood, and the lens was cataractous. There was great congestion of the circumcorneal blood vessels, much tenderness on pressure over the ciliary region, and dimness of vision so profound that the patient could only distinguish light from darkness. The history of the case, taken along with the appearances presented by the eye, made it almost certain that the globe contained a foreign body, and this diagnosis was confirmed by the Röntgen rays. The photograph clearly showed the shadow of a piece of metal in the ciliary region. The eyeball was enucleated, and when the globe was bisected, a minute piece of the casing of the cartridge was found in the position indicated by the skiagram.

3. In the above case the application of the Röntgen rays was really unnecessary, for all the circumstances of the accident made it practically certain that the injured eye contained a foreign body. In many instances, however, the X-rays afford very valuable assistance, for they render it easy to demonstrate the presence of a foreign body, whose existence would otherwise be doubtful. The following is a case in point: F. C., 21 years of age, was sent by Dr. Trimble of Strabane to

consult me on the 7th of November, 1900. The patient was a stonemason, and about the middle of September last, while he, along with other workmen, was hewing a block of granite, a splinter flew from a companion's chisel and struck him on the left eye. He was at once removed to a hospital in Londonderry, where he remained for six weeks, and shortly after he left that institution he was sent to Glasgow. When I first saw him the iris was discoloured, the pupil irregular, the lens cataractous, tension normal, and light perception good. An X-ray photograph revealed a foreign body in the vitreous chamber (Plate 1, fig. 2), and although, from the distinctness of the shadow on the sensitive plate, this was diagnosed to be of metal, the patient himself insisted that it must be a chip of granite. A magnet was applied to the eye, when immediately a sensation of pain was felt, the iris and lens bulged forwards, and a minute particle of metal darted through the cataract into the aqueous chamber, from which it was easily extracted. The cataractous lens was afterwards removed by irrigation with sterile saline solution, and the adhesions between the iris and the capsule were divided by Carter's scissors. The operation was followed by no inflammatory reaction, and a month afterwards the patient was able to count fingers at three feet, and after the remains of the lens capsule occupying the pupil were divided he could easily distinguish large objects, and guide himself about with the right eye closed. When he left for home ten days after the operation his sight was steadily improving.

The magnet employed in this case was one constructed for me by Mr. John Trotter of 28 Gordon Street, Glasgow, and it combines the advantages of the ordinary Hirschberg's electromagnet with the high traction power of Haab's giant magnet. This large portable magnet can, by the attraction of its core, lift a mass of iron weighing 2 cwts.; but the aim in its construction was to produce an instrument which would attract a small fragment of metal a considerable distance, rather than one capable of lifting a very heavy weight. When ready for use it is suspended from the roof of the operating room by two pulleys, and carefully balanced by a counterpoise. Into one end of the core a number of tips varying in size and shape

can be screwed, and when it is arranged in the manner just described, and connected with an electric current controlled by a special switch, its manipulation is quite easy. In practice it is better, however, to have in addition a Hirschberg's magnet at hand, because, if the rough edge of a chip of metal become entangled in the iris, there is great danger that the large magnet will extract it so rapidly and forcibly that a considerable portion of the iris will also be dragged out at the same time. It is better, indeed, after the foreign



body has been displaced from the deeper parts of the eye into the aqueous chamber, to complete the operation for its removal with a less powerful instrument.

4. Important as is the aid given by the Röntgen rays in demonstrating the presence of a foreign body in the eyeball, still more important is the assistance they afford in determining its exact position. The principles underlying the method by which this is accomplished were first described by Mackenzie Davidson, but, as is shown in the figure, my apparatus is somewhat simpler than his both in construction and in manipulation. The patient sits on a comfortable chair

with the head supported by a rest, to the upright of which is attached a curved arm carrying a pocket to receive the sensitive plate. By this means the latter can be brought closely in contact with the parts surrounding the eye to be photographed. The following is a good illustration of the advantages of the method: J. J., aged 36, an ironworker,



came to the Ophthalmic Institution on 23rd September, 1900. About six months previously he had been struck on the left eye by a chip of steel, but it was not thought that any foreign body had lodged in the globe. There was a well-marked cicatrix at the lower aspect of the cornea, to which the iris was adherent, but the intra-ocular tension was normal, and the light perception good, though the pupil was small and irregular, and the lens cataractous. Although the eye showed no sign of active inflammation, the patient complained that

it always felt irritable, and he had recently begun to fear that this irritation might injure the sound eye. As a small brownish spot, resembling rust, was noticed in the opaque lens, a skiagram was taken, with the result that a fairly large foreign body was detected, and localised in the lower aspect of the eyeball immediately behind the cataract. The patient was put under the influence of chloroform, an incision was made through the cornea, and after an iridectomy had been performed in the position indicated by the skiagram (Plate 1, fig. 3), the chip of metal was easily withdrawn from the eye by the electro-magnet. After this operation the patient recovered rapidly, but owing to the cataract the vision was not much improved. On the 26th of January of this year a capsulotomy was performed, with the result that the patient was afterwards able to distinguish large objects, and to guide himself about with the sound eye shut.

5. The above is an example of a successful operation for the extraction of a piece of steel which had been lodged within an eyeball for nearly six months. Such a fortunate result is, however, not by any means the rule, as in many cases the eye is damaged irreparably from the moment it is struck. The shock, the large size of the foreign body, and the great liability of the vitreous to become infected by septic organisms, all contribute to bring about a disastrous result. Obviously the sooner a foreign body is extracted from the eye after an accident, the greater the chance of preserving useful vision; but in many cases in which the operation has been promptly and successfully performed, the globe is ultimately completely destroyed by plastic cyclitis. The following is an example: On the 18th January, 1901, W. P., aged 21, was struck on the right eye by a chip of steel which flew from the head of a fellow-workman's hammer. He was brought to the Ophthalmic Institution within five hours after the accident, and a piece of metal was extracted by the electro-magnet, without much difficulty, through the original wound in the cornea. After the operation the patient suffered very little pain, and the inflammatory reaction was slight, but light perception steadily failed and in three or four days was lost altogether. By the end of a fortnight

the left eye was sensitive to light and watered considerably, and a few days later the injured eye became tender to pressure and began to soften and shrink. It was enucleated at once, and when the globe, after hardening in formaline, was bisected, it exhibited all the pathological changes associated with well-marked irido-cyclitis. In a short time there would almost certainly have been sympathetic inflammation of the fellow eye (Plate 2, fig. 2).

6. The presence of a foreign body may be demonstrated, and its position within the eyeball accurately localised, by the Röntgen rays, and yet there may be no possibility of extracting it. Such an unfortunate result may occur even although the foreign body be one which the electro-magnet will attract, for it is not at all unusual for a particle of steel to become so embedded in the tissues as to be completely insulated—the more minute the particle the greater this difficulty. The following is a good case in point: On the 16th October, 1900, A. F., aged 22, was sent by Dr. Alexander Stewart to consult me. The right eyeball turned outwards, and its lens was cataractous; and the patient's object in coming to me was to get the eye restored to its proper position and the cataract removed. Ten years previously his eye had been injured by a chip of metal, but although he had been under skilled treatment at the time of the accident the presence of a foreign body within the eyeball had not been suspected. A Röntgen-ray photograph, however, clearly revealed a small piece of metal in the ciliary region, but all attempts to extract it by the magnet failed. The cataract was easily removed, and as soon as the patient had recovered from the operation another skiagram was taken, and the foreign body was found to be in exactly the same position as before (Plate 1, fig. 4). Some weeks later a capsulotomy was performed, and since then vision has gone on steadily improving.

7. In A. F.'s case, although the sight is improved and the deformity lessened, the eye still retains the foreign body, and all experience goes to prove that under such circumstances destructive inflammation may arise at any moment. For years the foreign body may do no harm, and then suddenly and inexplicably there may be such a severe onset of cyclitis that

the eye will be lost, and only by prompt enucleation will its fellow be saved from destruction through sympathetic ophthalmitis. This was the state of matters mentioned incidentally in connection with the first patient referred to in this paper, but the case about to be narrated is probably even more interesting and instructive: On March 20th, 1900, J. H., aged 31, came to the Ophthalmic Institution complaining of recurrent inflammation of his left eye, the sight of which was rapidly deteriorating. He said that when he was about ten years of age he was standing one day in a blacksmith's shop, when he was struck on this eye by a piece of metal. He was skilfully treated at the time of the accident, and apparently made a perfect recovery. At all events, for more than twenty years the eye had never caused him a moment's discomfort, and, so far as he knew, sight was in no way impaired. Quite recently, however, more especially during the night, he had begun to suffer pain in the left eye, and to notice that the sight was failing rapidly. He could assign no cause for the occurrence of these inflammatory attacks, which had become steadily worse as time went on. When he was admitted to the hospital the eye was very painful and tender to touch, there was much circumcorneal injection, the iris was discoloured and tremulous, the pupil small and irregular, the vision very defective, and owing to opacities in the media no details of the fundus oculi could, on ophthalmoscopic examination, be distinguished. For a few days after admission the symptoms abated considerably, but on the night of the 30th March there was a sudden outburst of excruciating pain, accompanied by severe retching and vomiting, and in the morning the aqueous chamber was nearly a quarter full of pus. After this the patient's sufferings were much less, but the respite was of brief duration, and from this time onward he was tormented by constantly recurring attacks of pain and vomiting followed by the appearance of pus in the anterior chamber. In the intervals there was very little discomfort, but the eye was quite blind, and on the occurrence of a very severe relapse during the month of August the patient readily consented to enucleation. After the globe was hardened in formaline it was bisected, when it was seen that the lens was

dislocated, and the ciliary body and iris were inflamed, and as a probable cause of all the trouble a small fragment of steel was found firmly embedded in the ciliary region (Plate 2, fig. 3).

In this series of cases failures have been recorded as well as successes, and the latter are unfortunately few. Before, however, the magnet and the Röntgen rays were introduced into practice, there is not, as far as I am aware, a single instance on record of a foreign body having been removed from the vitreous chamber, and the sight at the same time saved. We may, therefore, justly regard the preservation of useful vision after such accidents as those I have referred to as one of the greatest triumphs of modern Ophthalmic Surgery.

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